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(19) (CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Erasable Printing Plate and a Process and Apparatus for Erasing and Regenerating the Printing Plate

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Notice: This application is as filed and may therefore contain an incomplete specification.



ABSTRACT OF THE DISCLOSURE

A printing plate which can be repeatedly directly provided with an image and erased and is
5 suitable for a wet offset printing method. The printing plate has a smooth and pore-free surface which is hydrophilic or can be hydrophilized after being provided with an image. The printing plate contains no strong microdipoles and consists of a
10 ceramic, a glass or a metal, in particular of a metal alloy. An erasing and hydrophilizing apparatus preferably integrated in the printing press, repeatedly erases and prepares, i.e. rehydrophilizes, the printing plate for a further image-providing and
15 printing process.



AN ERASABLE PRINTING PLATE AND A PROCESS AND
APPARATUS FOR ERASING AND REGENERATING
THE PRINTING PLATE

5 TECHNICAL FIELD

The invention relates to an erasable printing plate and to a process and an apparatus for erasing and regenerating the printing plate.

10 BACKGROUND ART

A printing plate suitable for the wet offset method is disclosed in DE 42 35 242 8. This printing plate has strong microdipoles at least in its outer layer, and its surface is hydrophobic. After
15 application of covering material corresponding to an image to be printed, the non-image parts are hydrophilized by a hydrophilizing agent. It is true that these printing plates have the advantage that they can readily be regenerated, i.e. after completion
20 of a printing process they can be erased in a simple manner and provided with further images. However, these printing plates have the disadvantage that it is expensive to produce them.

Regeneration processes which are suitable for
25 smooth as well as rough, porous printing plates of ceramic, glass or anodized aluminum are disclosed in DE 41 23 959 C 1. The disadvantage of these regeneration/erasing processes is that they are technically relatively complicated and expensive to
30 carry out.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a printing plate which can be
35 directly provided with images and repeatedly erased and which has the advantage of simpler production compared with known printing plates.

Pursuant to this object, one aspect of the present invention resides in a printing plate which has a pore-free and smooth surface with a roughness R_a of less than 1 μm . The smooth surface is hydrophilic or can be hydrophilized and plate material contains no strong microdipoles.

It is a further object of the invention to provide a process for repeatedly erasing and regenerating such a printing plate, which can be carried out within the printing press, without removal of the plate cylinder or of the printing plate.

Pursuant to this object, another aspect of the present invention resides in a process for erasing a print image on the printing plate, which process includes pressing a cleaning cloth against the surface of the printing plate using a pressure roller while the plate cylinder on which the printing plate is mounted slowly rotates. The cleaning cloth is unwound from a feed roller and is wound onto a wind-up roller either in a step wise manner or continuously. The pressure roller permits the contact pressure of the cleaning cloth against the plate cylinder to be varied. Additionally, nozzles supply cleaning solutions directly to the surface of the printing plate or to the cleaning cloth.

Another aspect of the present invention resides in a printing press which includes a plate cylinder on which the printing plate is mounted, and still further includes an erasing and hydrophilizing apparatus positionable at the plate cylinder for cleaning the printing plate and hydrophilizing the surface thereof.

According to the invention, there is provided a printing plate a printing plate which can be directly provided with an image and erased and is suitable for wet offset printing, the printing plate comprising a pore-free and smooth surface with a roughness R_a of <

1 μm , which surface is at least one of hydrophilic and hydrophilizable, the plate also contains no strong microdipoles.

The invention further provides a printing press
5 comprising a printing press. The printing press comprises a plate cylinder; a printing plate mounted on the plate cylinder; and erasing and hydrophilizing means arranged to be operatively positionable at the plate cylinder for cleaning the printing plate and
10 hydrophilizing a surface of the printing plate.

According to the invention, there is also provided a process for erasing a print image from a printing plate mounted on a plate cylinder, comprising the steps of: pressing a cleaning cloth against a
15 surface of the printing plate using a pressure roller while the plate cylinder slowly rotates; unwinding the cleaning cloth from a feed roller and winding the cleaning cloth onto a wind-up roller one of continuously and step wise; and applying a cleaning
20 solution via nozzles one of directly to the surface of the printing plate and to the cleaning cloth.

For a better understanding of the invention, its operating advantages, and specific objects attained by its use, reference should be had to the
25 drawing and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

30 The single figure shows, in cross-section, a printing unit having an apparatus according to the invention for erasing and regenerating the printing plate according to the invention.

35 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

For a printing plate to be capable of being

readily erased, it must be smooth and pore-free. Hence, it must not contain cavities, at least not in its surface, and must not be rough, so that no mechanical anchoring occurs between the surface and the image-producing material, printing ink or dirt, which can no longer be removed once contained in the surface cavities. To accomplish this the surface roughness R_a must be $< 1 \mu\text{m}$. To ensure that the printing plates are suitable for the wet offset method, their surface must be either hydrophilic or easily capable of being rendered hydrophilic. The printing plate is hydrophilized by spraying a hydrophilizing agent, such as a plate cleaner, onto it, for example from nozzles. The hydrophilic character of the surface must be capable of being restored even after thermal stress, i.e. after a thermal fixing step for material applied imagewise. Hence, it must at most become reversibly weaker or disappear reversibly.

Suitable materials for the production of such printing plates are, for example, ceramics. The plates can be prepared by the sol-gel process, a PVD or a CVD process, in a thermal spray process, for example the plasma spray process, or by a sinter process. The ceramic must then be ground as smooth as glass, i.e. it may only have a roughness $R_a < 0.3 \mu\text{m}$. If the printing plates produced in one of the stated processes are still not pore-free, they are subsequently sealed.

Ceramic printing plates contain, for example, alumina, aluminum silicate (mullite), zirconium silicate or zirconium oxide. It is particularly advantageous if the hydrophilic character of a ceramic printing plate not only is achieved by hydrophilizing the surface but is a volume property of the ceramic layer.

Instead of being produced from ceramic, printing plates having a smooth surface may also be produced from glass, preferably from a borosilicate-based glass which is resistant to chemicals and to heat.

Other materials for the production of the printing plates are metals, among which alloys having a good microstructural stability and high resistance to oxidation even during thermal cycling are particularly suitable. When used as printing plates, the metals have a surface smooth as rolled material with a roughness $R_a < 0.2 \mu\text{m}$.

Nickel chromium steels are particularly suitable for producing printing plates. Nickel-chromium-iron alloys and nickel-chromium-molybdenum alloys are preferably used, in particular the alloys obtainable from the company Heynes International Incorporated, Kokomo, USA, under the material numbers 2.4665 and 2.4619, 2.4602, 2.4636 and 2.4638, respectively. Other very suitable nickel-chromium-molybdenum and nickel-chromium-iron alloys are the alloys obtainable under the material numbers 2.4856 and 2.4851 from the company Huntington Alloy Product Division, Huntington, USA. The common feature of all these alloys is that, like the other alloys not named more specifically here, they have good resistance to the thermal cycling caused by the thermal fixing as well as good resistance to oxidation.

After the end of the printing process, such a printing plate which has been directly provided with an image and consists of one of the above-mentioned materials, a ceramic, a glass, or a metal, or at least has a surface layer of one of these materials, can be erased within the printing press in the manner described next. First, the printing ink residues and the coating applied imagewise are removed, for example

wiped off, by means of a cleaning agent. The cleaning agent is a solvent or solvent mixture that contains no solid components. In order to be able to remove even final and slight residues of the coating applied
5 imagewise to the printing plate, which residues otherwise cause so-called ghost images, the surface of the printing plate is then mechanically rubbed. A polish-containing cleaning agent, for example a plate cleaner, as generally used for cleaning printing
10 plates, serves for this purpose. The plate cleaner is then removed, for example with water, and the printing plate is rendered hydrophobic again by wetting with a solvent, in order to prepare it for a further direct-image-providing step. After provision of an image and
15 fixing, the printing plate is hydrophilized again, as also disclosed, for example, in DE 42 35 242 C 1, unless the material of the printing plate already has a hydrophilic surface and it is therefore sufficient if the non-image parts are hydrophilized again only by
20 the fountain solution during the printing process.

The apparatus shown in the figure is used both for erasing and for hydrophilizing and for fixing the printing plate described above, which is directly provided with an image, and other printing plates, as
25 disclosed, for example, according to DE 41 23 959 C 1 or DE 36 33 758 A 1. The fixing step comprises heating the printing plate provided with an image to a surface temperature between 170°C and 210°C by means of a drier 7. Alternatively, the printing plate can be
30 heated either inductively or by an infrared lamp. In other fixing processes, UV radiation or electron beams are used. It is also possible to cure the printing plates by suitable chemicals, for example merely by moisture.

35 The erasing and hydrophilizing apparatus is installed as a fixed unit in a printing unit of an

offset printing press and is arranged on the circumference of a plate cylinder 1 having a printing plate 2 which can be directly provided with an image. A rubber blanket cylinder 3 for transferring the print
5 image to a print medium, such as the print medium web 17 shown here, and rollers 4, 5 of an inking unit or of a damping unit rest against the plate cylinder 1.

An image-providing unit (not shown here) is likewise arranged on the circumference of the plate
10 cylinder 1, for direct provision of an image.

The erasing and hydrophilizing apparatus has a cleaning apparatus 6 and the drier 7, which can be fed toward the printing plate 2 and moved away from it again. The cleaning apparatus 6 operates by means of a
15 cleaning cloth or cleaning fleece 8, which passes from a feed roller 9 via a pressure roller 10 which presses the fleece 8 against the printing plate 2, and is then wound onto a wind-up roller 11.

The pressure roller 10 is in turn rotatably
20 mounted in a vibrating head 12. The vibrating head 12 is pressed against the printing plate 2 by means of a pressure cylinder 13. Nozzles 14, which are present in front of the cleaning apparatus 6 in the direction of rotation of the plate cylinder 1, can apply a cleaning
25 liquid or a cleaning paste, a hydrophilizing agent, for example a plate cleaner, or another agent which serves either for erasing the printed image applied to the printing plate 2 and for removing printing ink residues or for hydrophilizing the surface of the
30 printing plate 2, to the printing plate. This agent, together with the dirt which it removes, can be taken up by the cleaning cloth 8 if the pressure cylinder 13 presses the pressure roller 10 against the printing plate 2 and the cleaning cloth 8 is moved past the
35 printing plate 2. The nozzles 14 can preferably be adjusted with regard to their angle to spray the agent

either directly onto the printing plate 2 or onto the cleaning cloth 8. The pressure roller 10 is, for example, rubber-coated. The cleaning cloth 8 is wound either in portions or continuously from the feed roller 9 onto the wind-up roller 11. Preferably, the pressure with which the cleaning cloth 8 is pressed against the printing plate 2 can also be varied.

The printing plate 2 cleaned by the cleaning apparatus 6 can then be dried by the drier 7, with hot air via a hot air supply apparatus 15. The hot air flows subsequently, when it contains, for example, solvent residues, back through an extraction apparatus 16.

The erasing and hydrophilizing apparatus can, for example, be positioned alternately at the plate cylinder 1 or at the rubber blanket cylinder 3 if it is also intended to clean the rubber blanket by means of the erasing and hydrophilizing apparatus.

In another embodiment, the erasing and hydrophilizing apparatus is located outside the printing press, in order there to clean only printing plates 2 or rubber blankets.

The cleaning solutions used are solvents for removing the printing ink residues and the polymer layer applied imagewise, or other cleaning agents which contain abrasive media, such as, for example, some of the plate cleaners conventionally used in the graphics industry, or water for removing abrasive residues. The cleaning agents can be used one after the other in any desired sequence or in a changing sequence. Also, the printing plate surface to be erased can also be rubbed off with a dry cleaning cloth after or between the individual cleaning steps. In order to increase the efficiency of cleaning agents containing abrasive media, the cleaning cloth 8 preferably moves in a manner which changes.

The invention provides a printing plate 2 which can be repeatedly directly provided with an image and erased and is suitable for a wet offset printing method. It has a smooth and pore-free surface which is hydrophilic or can be hydrophilized after being provided with an image. The printing plate 2 contains no strong microdipoles and consists of a ceramic, a glass or a metal, in particular of a metal alloy. By means of an erasing and hydrophilizing apparatus 6, 7 preferably integrated in the printing press, the printing plate 2 can be repeatedly erased and prepared, i.e. rehydrophilized, for a further image-providing and printing process.

The invention is not limited by the embodiments described above which are presented as examples only but can be modified in various ways within the scope of protection defined by the appended patent claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

- 5 1. A printing plate which can be directly provided with an image and erased and is suitable for wet offset printing, said printing plate comprising a pore-free and smooth surface with a roughness R_a of $< 1 \mu\text{m}$, which surface is at least one of hydrophilic and
10 hydrophilizable, the plate also contains no strong microdipoles.
2. The printing plate as defined in claim 1, wherein said plate is made of a ceramic having a
15 surface roughness $R_a \leq 0.3 \mu\text{m}$.
3. The printing plate as defined in claim 2, wherein said plate is a ceramic prepared by one of a sol-gel process, a PVD process, a CVD process and a
20 thermal spray process.
4. The printing plate as defined in claim 2, wherein said plate is a sintered ceramic.
- 25 5. The printing plate as defined in claim 2, 3 or 4, wherein said surface is sealed.
6. The printing plate as defined in claim 2, 3 or 4, wherein said plate further includes at least
30 one of alumina, aluminum silicate (mullite), zirconium silicate and zirconium oxide.
7. The printing plate as defined in claim 2, wherein said ceramic plate is hydrophilic throughout
35 its volume.

8. The printing plate as defined in claim 1, 2 or 3, wherein said plate contains at least one phosphate compound.

5 9. The printing plate as defined in claim 1, wherein said plate is made of a chemical and heat resistant glass material.

10 10. The printing plate as defined in claim 9, wherein said plate is made of a borosilicate glass.

15 11. The printing plate as defined in claim 1, wherein said plate is made of a metal and has a surface roughness $R_a \leq 0.2 \mu\text{m}$.

12. The printing plate as defined in claim 11, wherein said metal is resistant to oxidation.

20 13. The printing plate as defined in claim 12, wherein said metal is resistant to oxidation during thermal cycling.

25 14. The printing plate as defined in claim 11, 12 or 13, wherein said metal is an alloy.

15. The printing plate as defined in claim 14, wherein said alloy is a chromium nickel steel.

30 16. The printing plate as defined in claim 14, wherein said alloy contains nickel, chromium and one of iron and molybdenum.

35 17. The printing plate as defined in claim 16, wherein the alloy is selected from the group of alloys represented by the material Nos. 2.4665, 2.4851, 2.4819, 2.4602, 2.4636, 2.4638 and 2.4856.

18. A printing press, comprising:
a plate cylinder;
a printing plate mounted on the plate
5 cylinder; and

erasing and hydrophilizing means arranged
to be operatively positionable at the plate cylinder
for cleaning the printing plate and hydrophilizing a
surface of the printing plate.

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19. The printing press as defined in claim 18,
wherein the erasing and hydrophilizing means includes
a cleaning apparatus with a cleaning cloth, the
cleaning cloth being arranged to be contactable with
15 the printing plate.

20. The printing press as defined in claim 19,
wherein said erasing and hydrophilizing means further
comprises a dryer operative to fix a print image
20 produced on the printing plate.

21. The printing press as defined in claim 19
or 20, wherein said cleaning apparatus includes
nozzles operatively arranged to apply a cleaning agent
25 to the printing plate.

22. The printing press as defined in claim 19
or 20, wherein said cleaning apparatus further
includes a pressure roller engageable with the
30 cleaning cloth for pressing the cloth against the
printing plate, and a pressure cylinder operatively
connected to the pressure roller for pressing the
roller against the cleaning cloth.

23. The printing press as defined in claim 22,
wherein said cleaning cloth is an elongate strip, the
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cleaning apparatus further including a feed roller and a wind-up roller, the cleaning cloth having one end attached to the feed roller and another end attached to the wind-up roller, the feed roller and wind-up roller being operative to draw the cleaning cloth from the feed roller over the pressure roller and onto the wind-up roller.

24. The printing press as defined in claim 22, wherein said cleaning apparatus includes a vibrating head mounted between the pressure cylinder and the pressure roller.

25. A process for erasing a print image from a printing plate mounted on a plate cylinder, comprising the steps of:

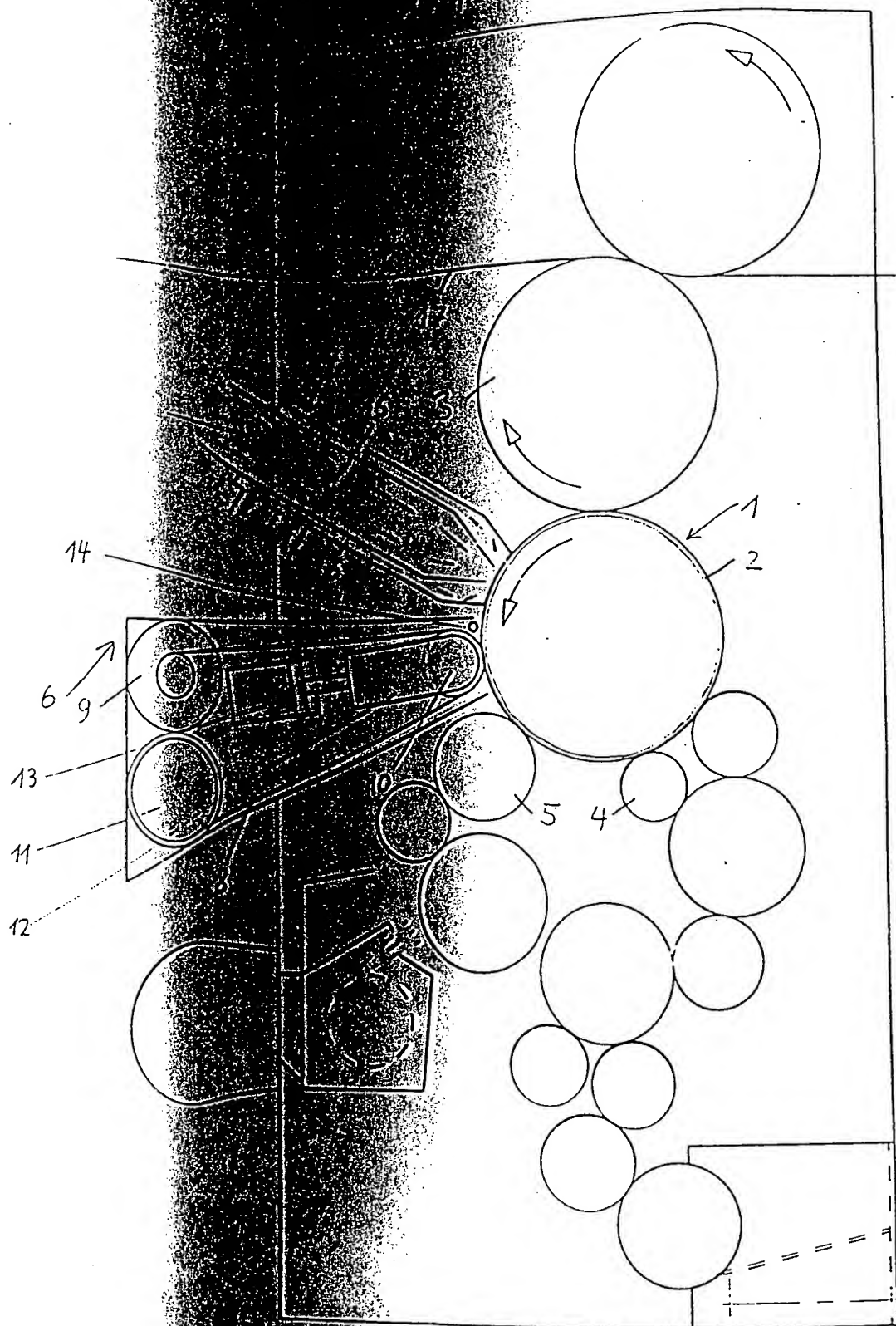
pressing a cleaning cloth against a surface of the printing plate using a pressure roller while the plate cylinder slowly rotates;

unwinding the cleaning cloth from a feed roller and winding the cleaning cloth onto a wind-up roller one of continuously and step wise; and

applying a cleaning solution via nozzles one of directly to the surface of the printing plate and to the cleaning cloth.

26. The process as defined in claim 25, including positioning an erasing and hydrophilizing apparatus which contains the cleaning cloth, the feed roller, the wind-up roller, the pressure roller and the nozzles one of within the printing press at the plate cylinder and outside the printing press for erasing the print image.

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PATENT AGENTS

Swaby Ogilvy Renault